Visualizing Polarization of Light

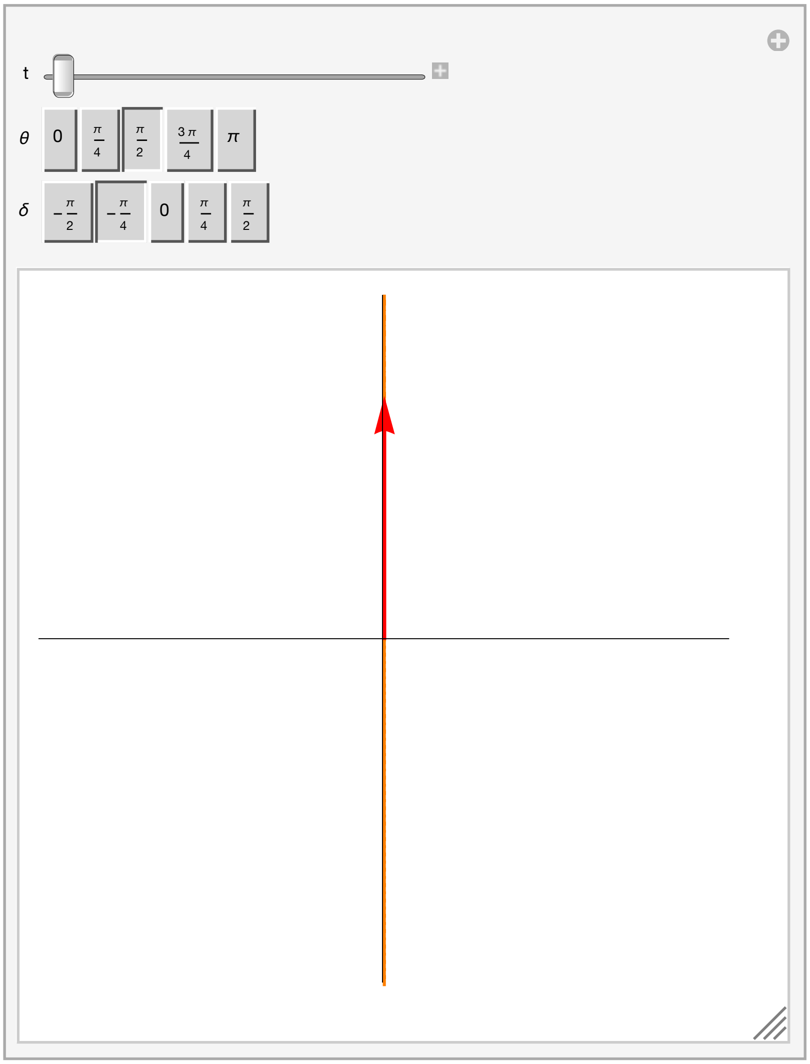
In textbook equation (2.37), we gave an expression for the electric field vector associated with an electromagnetic wave travelling along an axis that is perpendicular to the plane of this page. The electric field vector is given by

$$\mathrm{Cos}(\theta)\,\mathrm{Cos}(\omega\,t)\,\hat{\mathbf{i}} + \mathrm{Sin}(\theta)\,\mathrm{Cos}(\omega\,t+\delta)\;\hat{\mathbf{j}}$$

where we have set the parameters $\delta_0 = 0$, $E_0 = 1$, and $\hat{\mathbf{i}}$, $\hat{\mathbf{j}}$ are unit vectors along the horizontal and vertical axis respectively. In the simulation below we illustrate how that electric field evolves in time within the polarization plane (the plane perpendicular to the propagation axis, which in this case is the plane of the paper).

Start Simulation

```
Manipulate[
 Show[par[θ, δ], Graphics[{Red, Thick, v[t, θ, δ]}, PlotRange → {{-1, 1}, {-1, 1}}]],
 {t, 0, 1}, {θ, {0, Pi / 4, Pi / 2, 3 Pi / 4, Pi}}, {δ, {-Pi / 2, -Pi / 4, 0, Pi / 4, Pi / 2}},
 ContentSize → {400, 400}, SaveDefinitions → True]
```



Exercises

Use the above simulation to find the appropriate values of θ and δ, for

(a) Horizontal polarized light

(b) Vertical polarized light

(c) Linear polarized light at an angle of 45 degrees above the horizontal

(d) Right circular polarized light

(e) Left circular polarized light

(f) Elliptic polarized light